Ionex SG
Small Water System Economics for Near Zero Waste Denitrification.

- Small Community Treatment System.
- Brine Disposal Options for Rural Small Communities.
- Operations and Maintenance Costs.
- Co-contaminant Treatment.
- Capital Equipment Costs.

Phil Chandler, Managing Director and Mike Waite, Technology Director

Nitrate Technology Workshop
State Water Resources Control Board and California Department Public Health, September 5th, Sacramento, California.

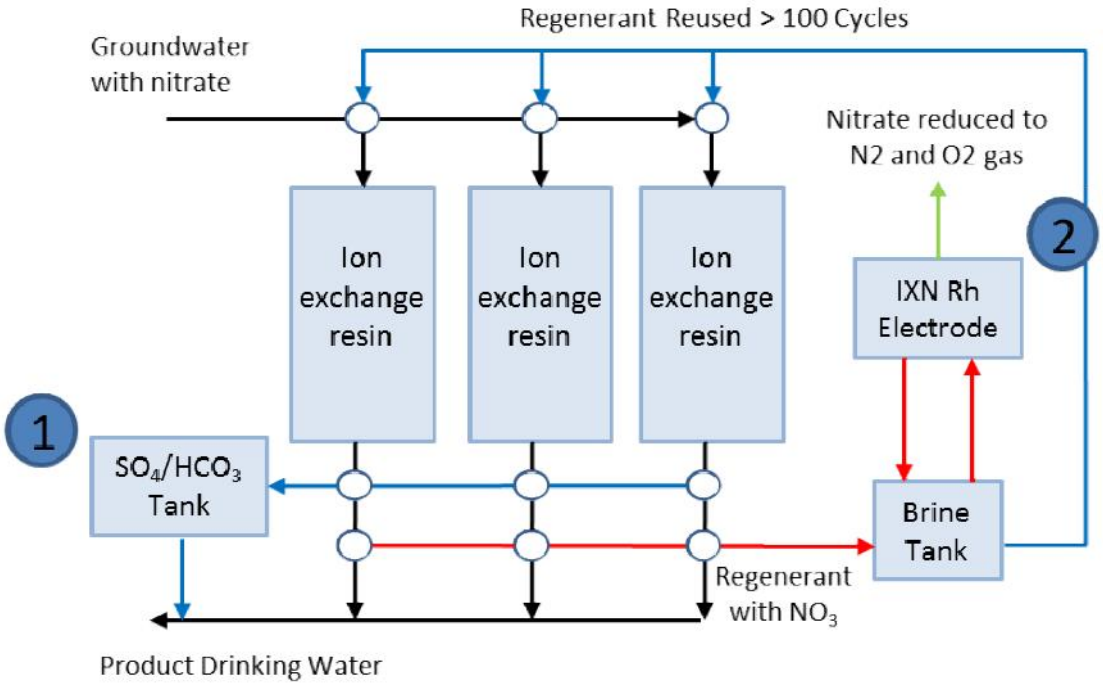
Affordable Nitrate Drinking Water System

- Advanced drinking water ion exchange treatment with onsite brine reuse.
- Our costs to produce drinking quality water per acre foot
  - Selective regeneration reduces operational costs to < $270/ ac.ft (83¢ per 1000 gallons)
  - Near zero waste brine reuse option reduces costs to < $149/ ac.ft (49 per 1000 gallons)
- Automated operation, continuous drinking water quality monitoring, ready to treat in a trailer for fast installation.
- NSF certified, validation testing for Conditional Acceptance with California Department of Health Drinking Water Program from September 2013.

Ionex Near Zero Waste System

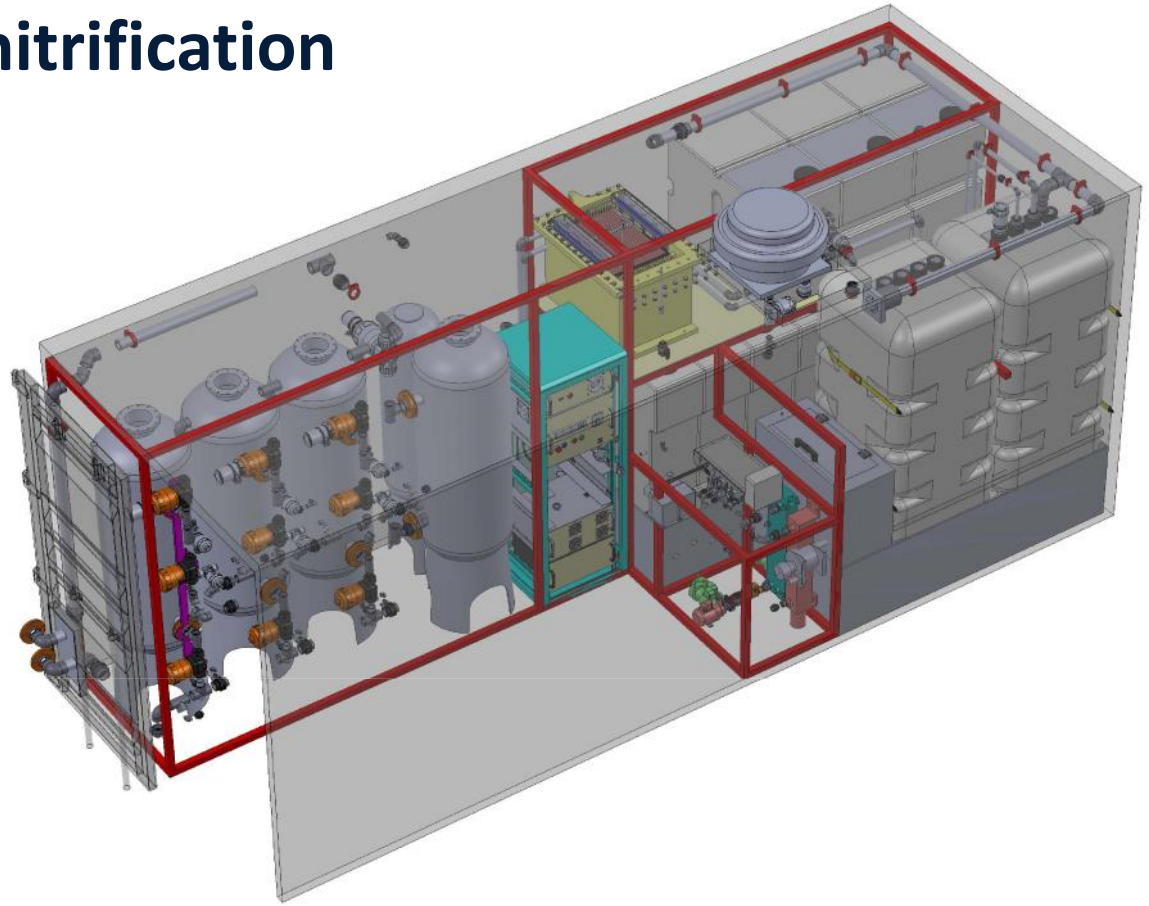
2 methods for reducing denitrification cost.

Sulfate Return (1) to drinking water reduces waste brine to < 0.12%
Brine Reuse (2) reduces waste brine to < 0.02%



Ion Exchange Resin Bead

Ionex Advanced Denitrification



IXL125 Small Community Nitrate Treatment System.

- 3 column ion exchange, Sulfate Return advanced regeneration.
- 2 nitrate analysers validating continual drinking water quality.
- NSF certified nitrate elimination cell, Brine Reuse.
- Hexavalent Chromium treatment.

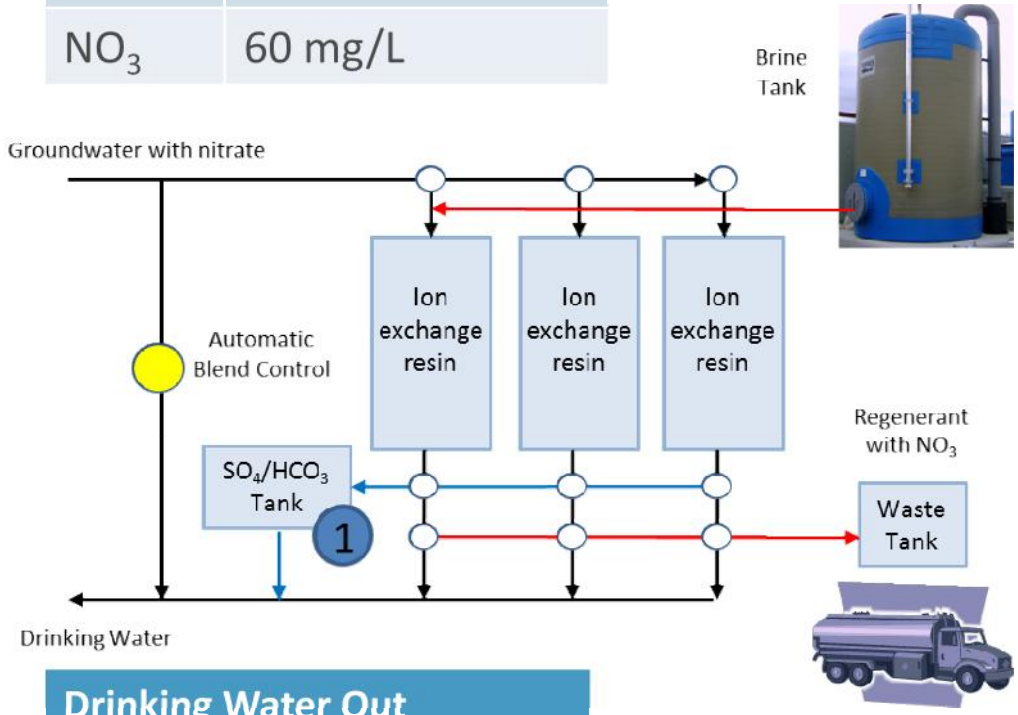
Sulfate Return Reliability Since 2006

- Patented Sulfate Return at 2 major English sites.
- Affinity Water 800gpm system near Cambridge.
  - Input nitrate average 57 mg/L (NO_3)
  - Drinking water output continuously 42 mg/L.
  - UK Nitrate MCl 50 mg/L (NO_3)
  - Waste volume under 0.18% for 7 years.

- Sulfate Return UK Government approved.
- Our Small System uses the same ion exchange design and control for sulfate return.
- 3rd UK sulfate return drinking water system is due online Spring 2014.

Sulfate Return 83¢ Cost for 1000 Gallons Drinking Water

Groundwater In	
Flow	72,000 gpd
NO_3	60 mg/L

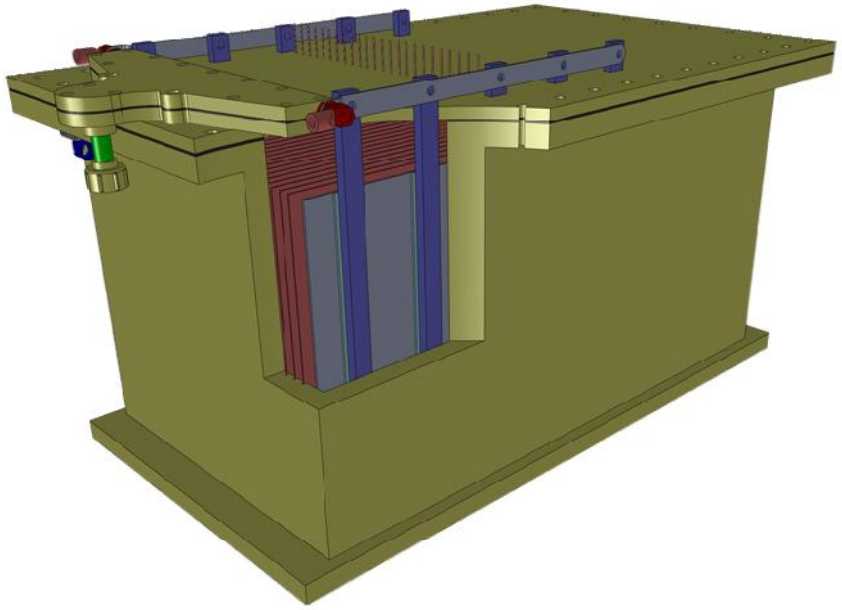


Drinking Water Out	
Flow	72,000 gpd
NO_3	36 mg/L

O&M	Quantity	Unit $	Total
NaCl	15 tonne	$80	$1,200
Power	4.7 (MW.hr)	$130	$610
Brine Waste	34,000 Gallons	$0.37*	$12,920
T2 Operator Duties -Quality Sampling, Inspections -Manage Suppliers / Disposal			$6,000
Specialist Services -Nitrate Analyser Calibration -Sensor Calibration			 $650 $450
		Annual Total	$21,830
		Cost per acre foot	$270
		Cost per 1000 gallons drinking water	83¢

*Brine Waste Visalia to Oakland
-$105 / hour truck hire plus 8% fuel surcharge
-(Visalia – Oakland roundtrip 12hrs*$105) * 1.08 = $1,360
-10c per gallon disposal charge

Brine Reuse for Near Zero Waste

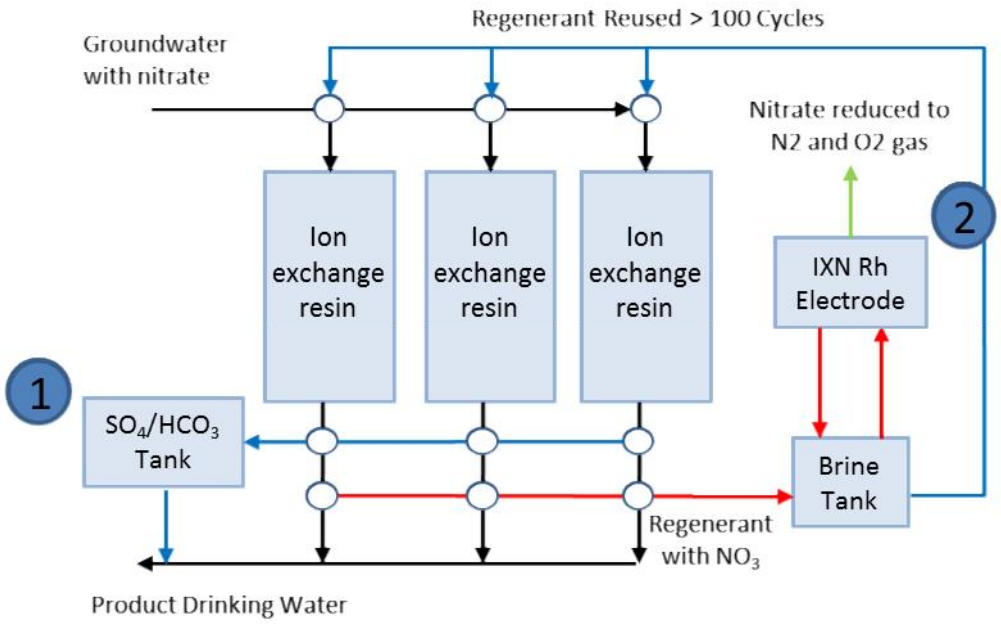


Electrocatalytic Nitrate Treatment.

- N bonds with Rh (cathode)
- O molecules form O_2 (anode)
- N molecules form N_2 (cathode)
- NO_3 reduced to $N_2 + O_2$

Brine Reuse 49¢ Cost for 1000 Gallons Drinking Water

Groundwater In	
Flow	72,000 gpd
NO_3	60 mg/L



Product Water Out	
Flow	72,000 gpd
NO_3	36 mg/L

O&M	Quantity	Unit $	Total
KCl	2.2 tonne	$690	$1,500
HCl	6 tonne	$235	$1,400
Power	20 (MW.hr)	$130	$2,600
Brine Waste	2000 Gallons	$0.37	$1,600
T2 Operator Duties -Quality Sampling -Check for Leaks -Manage Suppliers / Disposal			$3,000
Specialist Services -4 Brine Replacements -Nitrate Analyser Calibration -Sensor Calibration			$1,800 $650 $450
		Annual Total	$13,000
		Cost per acre foot	$149
		Cost per 1000 gallons	49¢

Ionex Small Community Project Management

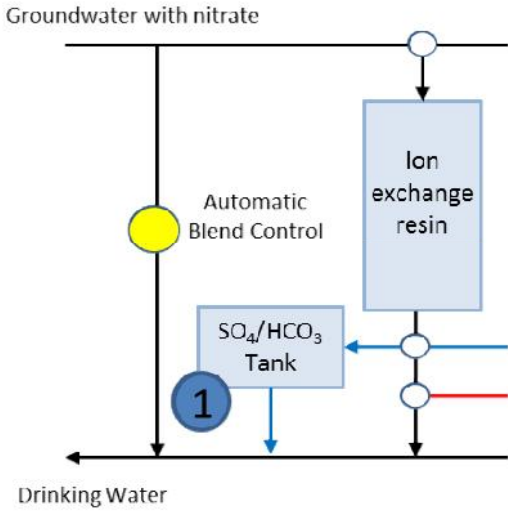
Action	Issues	Ionex	Community Costs
Well Review, Facility Review	Groundwater Composition -Cations, Anions. -Minerals, Particulates.	Forecast facility and operational costs.	
Validation Test	Ionex Pathfinder System -Real Performance Data. -Community 'Show and Tell'. -Spanish and English.		Power Groundwater 2gpm Drain 2gpm - For 3 weeks.
Preparation	Chemical Suppliers. Waste Disposal. Site Permits.	Recommend service providers.	7t Salt Tank $14K Waste tank $8K Chlorination $4K
Delivery and Installation	Delivery. Unloading and Positioning. Connections.	Delivery and site positioning included.	Electrical Power. Water Connections.
Commissioning, Training and Certification	Permits. T2 Operator Training.	Drinking water approval including certified analysis.	

Treatment of Co-contaminants

Contaminant	Drinking Water Standards	Treatment Option	Ionex
Hexavalent Chromium	Total Chromium MCl 50 µg/l Cr(vi) 10 µg/l	Ion Exchange proven to remove to << 10 µg/L. Nitrate ion exchange proven to remove Hex Chrome.	Hex Chrome treatment option available. Testing chrome waste reduction system.
Arsenic	10 µg/L	Ion exchange partially removes arsenic oxidation state dependant.	Testing segmented ion exchange regeneration to isolate As, U and Se fractions. Our plan is to optimise ion exchange.
Uranium	20 pCi/L	Ion exchange removes uranium complexed by fulvic acids.	
Selenium	50 µg/L	Ion exchange partially removes selenium oxidation state dependant.	
DBCP 1,2-Dibromo-3-chloropropane.	0.2 µg/L	Activated carbon	DBCP treatment option available.

Ionex Small System Treatment Capacity

Raw Water Nitrate	Drinking Water Nitrate	Nitrate Removal	Max Flow GPM	Nitrate Tonne Equivalent
72	36	36	125	3.6
66	36	30	125	3.0
60	36	24	125	2.4
54	36	18	150	2.1
48	36	12	200	1.9
44	36	8	260	1.7



Ion Exchange is flexible ideal for 'skimming' seasonal 'problem' wells back to compliance.

- Mobile treatment asset, fast deployment.
- Automatic blend control flexibility for high and low water volumes.
- Brine Reuse reduces trucking access requirements for salt and waste brine.

Capital Costs

Equipment Configurations		
IXL125 Sulfate Return (83c / 1000 gal)	3 column ion exchange, 50 micron intake filtration, segmented regeneration valving, automatic system control with smartphone communicator, 2 nitrate monitors (product water output quality control and ion exchange end point control) enclosed in 20ft container. Pathfinder Pilot.	$228,000
IXN125 Sulfate Return and Brine Reuse (49c / 1000 gal)	3 column ion exchange, salt saturator, 50 micron intake filtration, segmented regeneration valving, automatic system control with smartphone communicator, 2 nitrate monitors (product water output quality control and ion exchange end point control) enclosed in 20ft container. NSF Standard 61 Certified Electrochemical Nitrate 6te reduction cell, Electrode Power Supply and Controller, regenerant recovery and reuse tanks, chemical dosing tanks and dosing controller. Pathfinder Pilot.	$346,000

Ionex (Severn Glocon)

Severn Glocon designs and manufactures safety critical valves and complex well inspection systems for oil, gas and water applications.

Severn Glocon employs 800 people worldwide and is privately owned (picture Maurice Critchley London Financial Times 2013).

We received the Queens Award for Enterprise and International Trade in 2011.

Ionex SG is the Severn Glocon Environmental Division.

We are an original equipment design and manufacturing business with after sales service and support.

Our small community product and support offer for denitrification is designed specifically for rural locations.

http://www.severnglocon.com/divisions/ionex-sg

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